

&c., and which, by simple mechanism, punch corresponding holes in the paper when pressed down by the fingers. This operation being quite independent of the machine last described, can be carried on at any slack time, or when the type-setter is in use, and the prepared paper can be put away until the machine is ready to work from it. This is a special advantage of the system which printers will readily appreciate; and it possesses another of great value, and that is that parts of words of two to eight letters, and several short words, can be set up simultaneously, as the compartments are so filled that letters likely to come together are in contiguous divisions and may be released by the mechanism at the same moment. As an instance of this the eight compartments of one of the boxes are filled with types in the following order:—w i t h a t s and spaces, so that the ten words wit, with, it, that, hat, hats, at, as, is, and has, may be drawn by one operation, and the preparation of the paper for such combinations is no less simple, for it is performed by depressing several keys at once, as in playing chords in music.

By this system of type-setting, using one, two, or three perforators respectively, as many as eight, twelve, and twenty-four thousand types may be set up per hour.

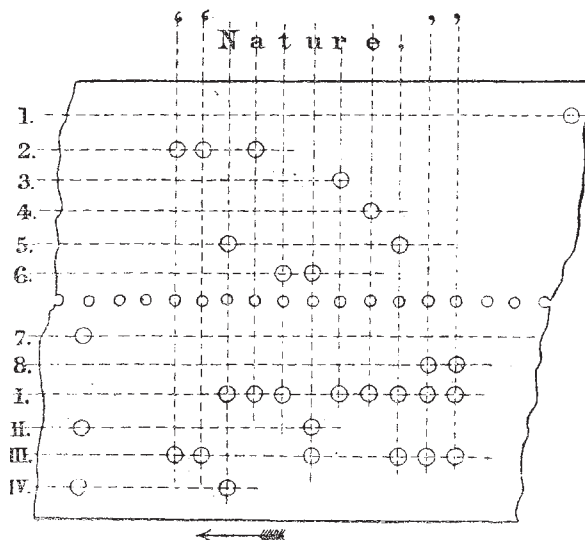


FIG. 2.

We have described Dr. Mackie's machine at some length, because it is a very beautiful application of the mathematical laws of permutations and combinations, and of mechanics to the saving of skilled labour, and is itself an interesting example of some of the services rendered by Science to the printer's art.

Another very ingenious application of Science to type-setting is the "Clowes" electrical compositor, invented by Mr. John Hooker. In this machine the types are contained in forty-eight nearly vertical troughs or reservoirs, and are pushed out through a lateral opening at the lower end by a *striker* under each trough actuated by an electro-magnet, so arranged that, when a current of electricity is sent through its coils, one type is released from its reservoir and drops out. Below the openings of the reservoirs are as many flat running tapes, and when a letter is released it drops on to the tape which is running below it, and is carried by it at the speed of seven inches per second to the edge of the table of the machine, where it is thrown on to another tape running at a quicker speed (about twenty-one and a half inches per second), and making an angle of about 150° with the set of parallel tapes before mentioned. This angle determines the relative distances

of the reservoirs from the quick-running tape, and the speeds are so adjusted to these distances that the time occupied by a type in travelling from the reservoirs to collecting apparatus is exactly the same in all cases so that the types are delivered into the composing-stick exactly in their order of release from the reservoirs. This part of the apparatus may in telegraphic language be called the "receiving instrument."

The "transmitting instrument" consists of a series of rectangular plaies of copper insulated from one another and arranged on a sloping board representing exactly the compartments in the ordinary compositor's "*Lower Case*." Each of these plates is in metallic communication with one end of the coil of one of the discharging magnets, the other end being in connection with one pole of a voltaic battery consisting of two small Grove elements. The compositor sits in front of this set of plates, having the copy before him, and holding in his hand a copper stile or contact piece which is in connection with the other pole of the battery. Every time he touches with the stile one of the rectangular plates of copper a voltaic current is sent through the coils of its corresponding magnet and a letter corresponding to the plate touched is liberated on to the tapes and is instantly carried to the composing-stick. The collecting apparatus is extremely ingenious and is worked by a quick running cam by simple mechanism, which is a beautiful specimen of workmanship.

By this machine as many as 15,000 letters per hour may be set up; and it possesses the advantage over other systems that it can be worked by any ordinary compositor *at case*, and requires no special training for its manipulation.

Of other type-setting machines there are exhibited in the collection examples of Kastenbein's system, which is adopted in the *Times* office; the Hattersley compositor, in which the types are, by the depression of keys, shot down vertical grooves, by which they are guided to the composing frame, and by which it is said that types may be set at the rate of 8,000 per hour. Muller's machine, which is represented in the collection by a model, is a well-made apparatus, intended to set type at a speed of 5,000 letters per hour. Both this and the Hattersley machine set up the type in columns, ringing a bell at the end of each line.

Heinemann's apparatus is an exceedingly simple machine, depending upon quickness of hand and eye in aiming a pointer at the particular divisions of a comb-shaped series of guides, by which the types are withdrawn from the reservoirs corresponding to those divisions. It is a well-made machine, and its simplicity is a safeguard against its becoming deranged.

The operations of type-founding, of paper-making and folding, of lithography, and steel engraving, which are all more or less dependent upon scientific aid, are all represented at South Kensington, but we must reserve their consideration for a future notice, as well as a description of an interesting gas-engine, exhibited by Messrs. Crossley Brothers, which is admirably adapted for laboratory purposes.

From what has been said it will be seen that the Caxton Exhibition is an exceedingly interesting and instructive one, and will well repay several visits. C. W. C.

NOTES

WE are glad to see that the first grants from the Research Fund of the Chemical Society have just been made. They are as follows: to Dr. C. R. A. Wright 50% for the investigation of certain problems in chemical dynamics; to Mr. G. S. Johnson 25% for a research on double salts with potassium tri-iodide; to Mr. E. Neison 25% for a research on octyl compounds; to Mr. Carleton Williams 25% for a research on hydrocarbons containing the group isopropyl twice; and to Mr. George Harrow 10% for a research on derivatives of aceto-acetic ether.

THE German Astronomical Society, as it is generally called, but really the International Astronomical Society, meets this year at Stockholm, from August 30 to September 1.

Now that the British Association meeting is again at hand, perhaps we may be permitted to urge upon the authorities the necessity for introducing some improvement in the daily programme published during the session. Last year (vol. xiv., p. 463) we noticed the handsome, full, carefully-arranged programme daily published by the American Association, and we have before us the *Tageblatt* of last year's meeting at Hamburg of the German Naturalists and Physicians. This is a quarto publication, each day's issue averaging twenty pages, and containing such important and detailed information that it is well worth binding and preserving. The rules of the Association are given in the first issue, a list of members with their addresses is given daily until complete, the arrangements for the meetings of sections and general meetings are clearly tabulated, a well-arranged general programme and list of all papers to be read each day are given, all information as to excursions, places to be visited, entertainments (including theatres), advertisements likely to appeal to members, summaries of each day's proceedings in the various sections, general meetings, dinners, &c.; in short every kind of information likely to make the proceedings be carried on with perfect smoothness and give the members the minimum of trouble and worry. Appended is a supplement of 180 pages containing reports of lectures given at general meetings and in connection with the various sections. All this contrasts strongly with the shabby tract-like programme issued during the meetings of the British Association; if the expense is an obstacle we are quite sure no member would object to a small charge if he could only be assured of obtaining each morning a well-printed journal on a scale similar to that of either the American or the German Association.

At the Congress on Domestic Economy to be held at Birmingham on the 17th, 18th, and 19th instant, under the presidency of Lord Leigh, Prof. Huxley will read a paper on Elementary Instruction to Children in Physiology, Mr. W. S. Mitchell one on the Practical Use of the Food Collection of the Science and Art Department, and Captain Galton on Warming and Ventilation. Many other papers bearing on the subject of the Congress will be read, and an exhibition will be organised.

MANY of our biological readers will be glad to know that Dr. George Bennett, F.Z.S., of Sydney, has arrived in this country, and that any communications directed to the office of the Zoological Society, 11, Hanover Square, will be forwarded to him.

THE Portuguese African Exploring Expedition left Lisbon for Loanda on the 7th inst.

MR. RICHARD S. FLOYD, one of the trustees of the Lick Californian estate, has been for a year past in Europe, investigating the comparative merits of reflectors and refracting lenses, for the great telescope. We are told by the *New York Tribune*, for various reasons, which he gives in detail, he decides against a large reflector, one point being that even if the extreme nicety of adjustment which the reflector requires could be attained in the new observatory, it would be liable to derangement in the high winds of a mountainous position. If a refractor is decided upon, estimates should be asked, Mr. Floyd says, from Cooke and Sons, of York, from Alvan Clark and Sons, and from Howard Grubb. He reports that the reputation of Clark's refractors and Grubb's, from all he can learn abroad, is about equal. The story of Mr. Lick's millions had preceded Mr. Floyd, and he has found it difficult to bring down the estimates of European opticians to the basis of ordinary business profit.

IN the debate on the education estimates, on Tuesday night, Sir John Lubbock, speaking on the extra subjects which had been made compulsory, said he doubted whether under any circum-

stances it would be desirable thus to stereotype one form of education for the whole of England; but surely we ought not to do so unless we were very clear as to what is the best system. There was, however, very great difference of opinion on this head. The first authority to which he would refer was that of a committee of that House. It was presided over by his hon. friend the member for Banbury, and after careful inquiry they reported that in their opinion "elementary instruction in the phenomena of nature should be given in elementary schools." The next authority which he would quote was the Royal Commission, presided over by the Duke of Devonshire, which unanimously recommended that more substantial encouragement should be given to the teaching of the rudiments of science in our elementary schools. In Scotland, too, great dissatisfaction was felt with the present system. At the last conference of elementary teachers, held in London, which was very numerously attended, it was resolved that the system of payment "embodied in the Code is unsound in principle and injurious to the progress of true education." The inspectors of schools differed greatly as to the most suitable subjects. Even in regard to geography they were not unanimous. It was said as a subject to lend itself very much to "cram." One of the inspectors gave in support some very amusing answers. For instance, in answer to a question of "What are mountains and rivers?" one girl replied that, "Mountains in some parts of the world are very useful. In Africa, for instance, they shoot out gold." Of rivers she had not so favourable an opinion, though she thought "they were all very well in some countries where there was very little rain." He confessed, however, that he thought geography a very good subject, though he was not convinced that it ought to be continued during the whole course to the exclusion of other subjects. The mere skeleton of history taught in our elementary schools contained little more than dates, wars, and murders; but dates and crimes no more constituted the history of a nation than sinews and bones made a man. Men of science must be grateful to Sir John Lubbock for so constantly urging upon Government the importance of scientific education.

THE first practical response to the proposal for the establishment of a colonial museum in London has come from the Legislative Council of Ceylon, which has voted as its contribution a sum of 15,000*l.*, to be paid in three annual instalments. The Council of the Colonial Institution is about to issue another circular on the subject to the colonial Governments.

AT the last sitting of the French Geographical Society, excellent news was received from M. de Brazza, the French explorer of the Ogové. He reached a distance of 250 miles beyond the place where M. de Compiègne was obliged to retreat hastily to save his life. He finds that Ogové does not bend towards the Zaire. If its course does not change further up, both streams may belong to a single system. It was reported, also, that M. Say, a French officer in the National Marine, had reached the Hoggar, in Central Africa, but the news requires confirmation.

THE *Bulletin* of the Paris Geographical Society for April (just issued) is mainly occupied with a long and elaborate review of the geographical work of the year 1876, by M. Ch. Maunoir. M. de Bizemont discusses some of the observations for latitude obtained by M. de Brazza during his exploration of the Ogové. In connection therewith M. de Bizemont gives a list of the instruments which he considers most useful to explorers in new countries.

AMONG the papers in this month's part of *Petermann's Mittheilungen* is one on the Cartography of the Philadelphia Exhibition; Dr. Güssfeldt contributes an important paper on the exploration, by himself and Dr. Schweinfurth, of that part of the Arabian desert between the Nile and the Gulf of Suez; and Dr. Radde a paper on the plain of the Upper Euphrates. Dr.

C. E. Jung has the first part of an important contribution on the Geographical Outlines of South Australia.

THE *Geographical Magazine* for July contains a masterly paper, with an elaborate and carefully-constructed map by Mr. Trelawny Saunders on the Himalayan system. Both article and map are evidently the result of thorough study and extensive knowledge.

FROM a Report of the Board of Commissioners of the New York State Survey, which is under the charge of Mr. J. T. Gardner, formerly of the United States Geological Survey, we learn that, although the Survey was decided on only in 1876, much has already been done in the way of commencement, and that it is likely to be carried out with a thoroughness quite equal to any of the trigonometrical surveys of Europe.

MR. LANDSBOROUGH, the well-known Australian explorer, recently read a paper at Oxley, Queensland, in which he adduces a variety of interesting facts to prove that dense forests are on the increase in Australia, that the climate is becoming moister, and therefore improving, that the country is gradually ceasing to be favourable to sheep-rearing, and becoming agricultural, and seems to hint that in course of time the great central desert may yet "blossom as the rose." Formerly when there were no sheep to keep down the grass, fires were frequent and terribly destructive to trees and all vegetation, but since the stocking of the country there is less grass for the fires to consume, and their ravages are consequently becoming limited in extent. Queensland, especially, Mr. Landsborough declares, is now so unfit for sheep-pasturing, that no one thinks of making a living by them. The observations of this experienced traveller are well worthy of attention, and it will certainly be interesting to watch the changes caused by the presence of civilised men in Australia, as we know exactly its condition at their first advent.

M. WADDINGTON, the late French Minister of Education, our readers may remember, sent out a number of men to various countries for the purpose of scientific exploration. The following is a list of these missions:—M. Masqueray in Algeria; MM. Pinard and de Cessac, North America; M. la Gaviniere, Celebes; Marignac, Antilles; Armingaud and Malard, Italy; Dr. Harmand, Cochín China; Wiener, Peru and Bolivia; Raffray and Maindron, New Guinea; Ed. Blanc, Maritime-Alps; Ratte, New Caledonia; Ujfalvy, Central Asia; Serre, Say, Sahara; Rochemonteix, Egypt; du Chatelier, Finistère (France); Abbé Ansault, Italy; Mangeot et Bersot, Japan; Mouchez, Algeria; Guizet, Japan and China.

WE have received the *Bulletin*, for 1876, of the Essex Institute (Salem, U.S.), one of the best of the many local societies of the United States. A large portion of the *Bulletin* is occupied with a valuable paper by Mr. E. W. Nelson, on the birds of North-East Illinois. We may state that this Institute is issuing a series of "Historical Collections," which are likely to be of service to those who are interested in the political history and social progress of the United States.

THE *Kansas Collegiate* is the title of a small sheet conducted by the students of Kansas State University, and contains various notes and news likely to interest those for whom it is intended. The number for May 23 contains a Scientific Supplement devoted to subjects of more or less scientific importance. The longest of these is an address by Prof. F. H. Snow, on "The Relation of Birds to Horticulture," and which contains some interesting information on the habits of many of the Kansas birds. Another paper, by Prof. G. E. Patrick, gives the results of an examination of a meteorite found at Wacender, Mitchell Co., Kansas. Prof. Snow, we notice, has formed a fine and constantly-increasing collection of the birds of Kansas.

THE *Commission Supérieure*, or governing body of the French International Exhibition of 1878, has been completed by the appointment of some influential members, among whom are the Duc d'Audifret-Pasquier, president of the French Senate, M. Andral, the vice-president of the Council of State, M. Alphaud, the chief engineer of the Paris works. Amongst the ordinary members are M. Brunet, Minister of Public Instruction, M. St. Claire-Deville, member of the Institute, and M. Rothschild the banker. M. Krantz has given a detailed report on the state of the works, which are much in advance of the specified time. The unexpected success of the exhibition in foreign countries and especially in Great Britain and the British Colonies will fill up the vacuum created by the abstention of Germany. Many nations have asked for an enlargement of the space allotted which it has been impossible to grant. The public will be admitted by tickets and not by turnstiles. The coffee-houses, balls, concerts, theatres, so numerous in the 1867 exhibition, have been abolished, but great experiments for testing the apparatus exhibited, and promoting human knowledge will be tried. China will be represented by an official commission, and Siam will make a magnificent display. Liberia, the negro republic on the Gold Coast, will exhibit for the first time in France.

THAT science in certain of its applications does pay is evident from the fact that a M. Delille, a "professor" of legerdmain, who has practised at fairs in France, and who has died at the age of eighty-eight, gained by his trade a fortune valued at several millions of francs. He began to practice at the early age of sixteen, and was seen operating at the last fair of St. Germain. He dealt largely with electricity. Here is another argument against the Endowment of Research very similar to one which has been urged before.

FROM the prospectus of St. Thomas's Hospital Medical School, we notice that two scholarships of the value of 60*l.* and 40*l.* respectively will be awarded during the first week in October, after an examination in physics, chemistry, botany, and zoology.

THE King of the Belgians, who has been appointed a second time president of the International Association for Exploring and Civilising Central Africa, has declared that next year he will decline to continue the office. The Society is possessed of an annual revenue of 73,000 francs, principally from subscriptions obtained in Belgium, where the scheme is very popular. It has been decided by the executive committee that a station should be founded in the Trans-Tanganyika region. The head of the station and the explorer have been appointed. A depot will be formed at Zanzibar, and three others in intermediate countries; one is to be placed under a Catholic mission, and two under two Protestants, who have volunteered to help the Association. The works are to be begun without further delay.

A COMPANY is now being formed, we learn from the *Engineer*, to construct a pneumatic railway between the South Kensington Station of the District Railway and the Albert Hall. The line will rise the whole way to the Albert Hall, the ruling gradient being 1 in 48. The train will be blown through the tube by an ejector, in other words, a great centrifugal pump, two feet in diameter, fixed close to the District station, and worked by a pair of condensing engines exerting about 170 indicated horse-power. The tunnel will be of brick, and the floor will be paved. Its cross-sectional area will be 105·5 square feet; at the end of the train is fixed a screen or piston, with an area of 104 square feet, the difference being allowed for windage. The train will consist of six carriages, of very light build, the rail gauge being four feet. This train will hold 200 passengers, and the total load will be thirty-two tons, or ten tons less than

the weight of a single engine on the Metropolitan Railway. The maximum resistance at twenty miles an hour will be about 2,420 lbs., requiring to overcome it a pneumatic pressure of 2·6 ounces per square inch, and 162-horse-power, assuming the useful effect to be sixty per cent.

A VERY severe thunderstorm passed over London on the evening of July 5. Between eight and nine there came a very brilliant flash of lightning, followed by a deafening peal of thunder. Many people were stunned and in several cases were found quite insensible. Immediately after it was found at Kilburn that the telegraph wires, running from the top of the Queen's Arms to a house about 300 yards higher up the Edgware Road, were struck by the lightning, and fell in red-hot fragments, varying in length from six inches to an inch, all along the road, a great deal of yellow smoke attending the fall of the wire. In one or two houses windows were broken, and a little girl who was passing through the street had her hair singed and her jacket burnt. The instruments at the office with which the destroyed wires were connected were much agitated, and the telegraph clerk, a young lady, was much stunned.

THE fourth edition of the "Lists of Elevations principally in that portion of the United States West of the Mississippi," edited by Mr. Henry Gannett, and published in connection with Mr. Hayden's Survey, must prove of great value to the geographer and meteorologist. The first edition, published in 1872, contained only thirty-one pages, the present edition contains 164 pages. It contains, among a variety of other matter, profiles of nearly all the railroads in the part of the United States above mentioned. The results given by these profiles have been made to accord, and the heights of several thousands of points on them have been determined with an approach to accuracy. This edition contains also the heights of many thousands of points determined approximately by means of the barometer. Elevations of many thousands of mountain-peaks are given, from which very correct ideas of the ruling heights of the principal ranges may be derived. It contains also tables of the slopes of the principal streams of the west, which are of value in studying the important question of irrigation. With these various lists of elevations there is given with this edition a map of the United States, in approximate contours of 1,000 feet of vertical intervals, which, in a measure, embodies all the results of this department. Toward the improvement and ultimate perfection of this map this work is to be mainly directed in future. To express still more clearly the facts brought out by the map, it is the intention of the Survey to make shortly a relief model of the United States, on the basis of this map.

WE have on several occasions referred to the association known as the Yorkshire Naturalists' Union, composed of a large number of local scientific societies in Yorkshire. This association publishes a useful monthly journal, *The Naturalist*, intended as a general field club record. We have received the twenty-fourth number of this journal, which, besides several papers on natural history, contains reports of several of the associated societies. From a report of the third meeting of the Union held recently at Wakefield, we notice that the Bradford Scientific Association was admitted to the Union, and that a testimonial, in the shape of a microscope, was presented to Mr. J. M. Barker, late secretary of the West Riding Consolidated Naturalists' Society.

THE additions to the Zoological Society's Gardens during the past week include four Common Kingfishers (*Alcedo ispida*) European, presented by Mr. J. Lyford; two Horned Lizards (*Phrynosoma cornutum*) from Texas, presented by Mr. W. A. Bowie; a Sun Bittern (*Eurypyga helias*), a Sacred Ibis (*Ceronticus aethiopicus*), bred in the Gardens; eight speckled Terrapins (*Clemmys guttata*), three Red-vented Terrapins (*Clemmys rubriventris*), two American Box Turtles (*Terrapene carolinata*) from North America, purchased.

THE INFLUENCE OF LIGHT UPON THE DEVELOPMENT OF BACTERIA¹

WE have been engaged during the last few months on an investigation into the effect of light upon the development of bacteria in certain of those solutions in which they are usually produced.

We reserve the details for a paper which we hope to submit to the Royal Society in the course of their next session, but wish to state, in the meanwhile, that the first portion of our inquiry has led us to the following conclusions:—

1. That light is inimical to the development of bacteria.
2. That under favourable conditions it may prevent their development.
3. That under less favourable it may not prevent but only retard.
4. That for the full effect of light to be produced direct insolation is necessary.
5. That those conditions which tend to neutralise the action of light are the same which are known to favour processes of fermentation and putrefaction.
6. That the fitness of the solution to serve as a nidus is not destroyed by insolation.
7. That, so far as our investigation has yet gone, it would appear that the germs originally present in the solution are destroyed by direct insolation.

We are still pursuing the inquiry, and have devoted much time to investigating the influence of the refrangibility of the ray, but regret that at present we are not in a position to give any definite conclusions on this point.

We are endeavouring also to trace an analogy between facts which we have observed and certain vital and chemical processes, in which light is known to play a part, and are extending our observations to other phenomena of fermentation and to microscopic fungi.

That light is not essential for the development of bacteria has been long known, but that it is absolutely inimical to their production has not, so far as we are able to ascertain, been previously shown, and we are encouraged, therefore, to lay before the readers of NATURE this statement of our results.

ARTHUR DOWNES; T. P. BLUNT

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

LONDON.—The following is the list of the new associates of the Royal School of Mines:—Associates in Mining and Metallurgy—C. W. Folkard, A. K. Huntington, E. W. Voelcker; Associates in Mining—E. H. Liveing, W. H. Merritt; Associates in Metallurgy—A. C. Copeland, J. F. Hogan, C. H. Lemann, W. Leyson, E. T. McCarthy; Associate in Geology—A. R. Sawyer. The Edward Forbes Medal and prize of books was awarded to A. Heilprin; the De la Beche Medal and prize of books to E. W. Voelcker; the Murchison Medal and prize of books to F. G. Mills.

SCIENTIFIC SERIALS

Journal de Physique, June.—On the theory of electrometers, by M. Mascart.—On the dynamical theory of gases (continued), by M. Violle.—Process for measuring the index of refraction of liquids, by M. De Waha.—Application of the electric current to the study of the spheroidal state of liquids, by M. Hessehus.—Temperature and humidity of the air at different heights observed at Upsala during 1875, by M. Hamberg.—Proceedings of the Physical Society of St. Petersburg.

Archives des Sciences Physiques et Naturelles, June 15.—Study on the variations of transparency of the waters of Lake Lemman, by M. Forel.—On the different modes of crystallisation of water, and the causes of the varied appearances of ice, by M. Pictet.—Researches on some niobiferous and tantaliferous minerals, by M. Delafontaine.

Annalen der Physik und Chemie, No. 4, 1877.—Johann Christian Poggendorff (memoir).—New experiments on the expansion of bodies by heat, by M. Glatzel.—On the objections of Clausius to Weber's law, by M. Zöllner.—On normal magnetisation, by M. Petruscheffsky.—On stratification of the electric light in Geissler tubes after insertion of a flame and some other resistances, by M. Holtz.—On the cohesion of salt solutions, by M.